MRP II Standard System

A Handbook for Manufacturing Software Survival

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Chapter 5
Demand Management

Demand management encompasses the areas of forecasting, customer order entry, distribution, and interplant movement of material and as such is an integral part of the high level planning and scheduling process. In a manufacturing company, forecasts and the backlog of customer orders are the starting point for company business plans, the sales and operations planning process, and the master production schedule. The customer orders also may identify future requirements for the final assembly schedule. In a distribution business, demands from physical distribution play a major role in the development of valid production plans and master production schedules.

Demands are one of the inputs to the sales and operations planning and master production scheduling processes. The demands for a product family or item are not the sales and operations plan or the master production schedule itself. Instead, they are combined in a process of human judgment and evaluation to produce a valid sales and operations plan and individual master production schedules.

The purpose of demand management is to develop the most reasonable projection of future requirements, and then update this projection when change is warranted. By properly managing the different demand streams, trivial changes to the sales and operations plan and master schedule can be avoided—and meaningful differences in the marketplace can be recognized at the earliest possible moment so that effective action can be taken.

The demand management capabilities in the system must recognize that forecasting, customer order promising, etc. are a people process, and that the essence of effective demand management is good communication, quick feedback, and properly defined accountabilities. The computer logic that is part of an effective demand management system should support these important activities.

FORECASTING SYSTEM

For most companies, a significant portion of the demand management and high-level planning activities starts with the forecast. Forecasts are a primary input to the business plan, the sales and operations plan, and the master production schedule. The management of a company and the master scheduler must evaluate the

forecast along with the other factors that make up the business plan, sales plan, and the master production schedule.

Forecasting, like many business functions, is a management process with specific accountabilities: it also happens that for many companies the computer can provide significant assistance in developing and updating the forecast. In the end, though, people evaluate and approve forecasts and develop sales plans to make the forecast happen. Ultimately, people have to be held accountable for hitting the forecast.

A comprehensive forecasting system should have four basic functions:

1. Several simple forecasting techniques and a method for evaluating these different techniques.

2. A way to take seasonal factors into account.

3. A way to break down and allocate forecasts of families of items by warehouse, configuration, package size, etc.

4. A way to review and approve the forecast before updating the system.

The functions that should be part of a comprehensive forecasting system developed over a number of years of experience working with forecasting systems. For a long time, there were two major misconceptions about forecasting. One misconception was that it was possible to develop a "right number"; that by developing more and more sophisticated and complicated forecasting algorithms it would be possible to compute the right number. The other misconception was that it was possible to develop a single technique that would work to forecast all items.

For many years, most research on forecasting focused on sophisticated mathematical approaches like multiple regression analysis, least squares, correlation analysis, adaptive smoothing, Box Jenkins, etc. This was an attempt to develop a single sophisticated forecasting technique that would generate the right forecast, and which would work for all items.

Unfortunately, with each increase in sophistication came a corresponding decrease in the ability of humans to evaluate and use the forecasts, with little improvement in forecast accuracy.

Most of the effort expended in developing forecasting techniques has been in the area of mathematical optimization. Yet experience shows that if people don't understand why a system produces certain numbers or recommendations, typically because of the complexity of the mathematics used to develop those numbers, then they will not be able to use the system effectively. In most cases, the advances in forecasting techniques have actually made it more difficult to understand and use the forecasts that can be generated.

Today, the trend is waning away from mathematical optimization and moving toward simulating alternatives. Instead of trying to find the single right formula that will generate the one right forecast, companies are using the computer to simulate different forecasting strategies and evaluate their effectiveness. People can then review the different strategies and the recommendations of the forecast-

ing system, choosing the technique that makes the most sense in developing a forecast of future sales.

This approach to forecasting is called focus forecasting (*Focus Forecasting: Computer Techniques for Inventory Control,* Bernard T. Smith, Oliver Wight Limited Publications, Essex Junction, Vermont, 1978). Focus forecasting is a system that can simulate and evaluate a number of different strategies, selecting the forecasting technique that would have proven most effective in forecasting the recent past. The forecasting techniques that are part of a focus forecasting system are typically simple techniques like a moving average or simple strategies like "whatever we sold the last three months is probably what we'll sell the next three months," but they could be sophisticated mathematical approaches. In addition, some companies may also find it important to include models of product life cycles for assistance in forecasting. All these techniques are accommodated by the focus forecasting approach.

Most people using focus forecasting systems end up choosing simple forecasting strategies because they are easy to understand and use. In addition, the benefits from focus forecasting come from using a computer to simulate alternatives, rather than from using it for a single sophisticated technique to develop the "right answer."

Effective forecasting software accommodates both the intrinsic and the extrinsic factors that may make up a forecast. Intrinsic forecasts are based on the past. The most common ways to make these predictions use an average, a moving average, or a weighted moving average. The extrinsic forecasts are based on outside information like marketing information, etc.

The strategies that are part of a forecasting system must provide a way to take seasonal factors into account. This would allow the system to handle regular patterns that repeat at certain times each year. For example, demand for both cigars and cosmetics is highly seasonal. This seasonality can be analyzed and some numbers developed for each time period. These numbers, often called base indices, can then be used to spread the total forecast over the year, quarter, or month in whatever pattern makes sense.

The forecasting system must also provide a way to break down and allocate forecasts for families of items by warehouse, configuration, package size, etc. In a Distribution Resource Planning system, for example, it is necessary to develop sales forecasts by item and distribution center. Many companies choose to develop a nationwide forecast, and break it down into individual item and distribution center forecasts. This breakdown would typically use historical percentages. This same approach can be used to take an overall product family forecast and break it down to specific forecasts by product configuration or package size.

Similarly, the system must provide a method for reconciling the aggregate forecast for a product family with the sum of the individual forecasts by item. Reconciliation of the forecasts might mean adjusting the aggregate forecast in some situations. In other situations, the individual forecasts might be recomputed using a proration of the aggregate forecast.

Finally, and perhaps most importantly, a forecasting system must have a way to review the forecast after it has been generated and before the system is updated. The experience of operating effective forecasting systems shows that the key is

to combine simple forecasting techniques with good human judgment. A human being will be responsible for the forecast, and a human being needs to review it before it is updated. A person must have the opportunity to change the forecast before it goes into the system so that he or she can be held accountable for the forecast being used.

ORDER ENTRY SYSTEM

An order entry system is used to add, delete, and change customer orders. If the item ordered by the customer is planned by MRP, the customer order will be presented to the MRP netting and exception checking logic as a demand. If the item is controlled through the master scheduling system, these customer demands will be presented to the master production scheduling netting and exception logic.

The order entry system must be able to create multiple line items on a single customer order. The multiple line items may be for different items on the same date, for different items on different dates, or for the same item on different shipment dates. Each line item represents a demand to MRP or the master scheduling system. One or more shipments may be included on a single customer order.

Five pieces of information are required for each customer order line item. These are the item number, required (promised) date, quantity, customer order number, and customer request date. The item number is used to present the customer order information to MRP and master scheduling. The required date and quantity are used in the netting and exception logic. The customer order number is needed for pegging. The customer request date is the date the customer originally specified for the line item, and may be different from the required date or promised date that is being used in the MRP or master scheduling system. For example, the customer may have asked for the item in week three, but, because of supply problems, it will not be available until week six. In this case, the date the customer is promised is week six, but the request date for the item is week three. The customer request date is needed for an available-to-promise check when the order is entered, and can be helpful for performance measurement, forecasting, and forecast consumption.

Besides having the capability to create customer orders and customer order line items, the order entry system must be able to change and delete existing orders. Once a customer order has been created, the information must be available for change. It must be possible to change the required date and the quantity for each line item. When a customer order is deleted, the system should close the order and remove each of the line items regardless of the order status. When a customer order line item is deleted, the system should remove the line item, and if all line items are completed or closed, mark the order complete.

Paperwork to assist the stockroom or finished goods inventory people may be helpful and can be produced when the customer order is ready for shipment. This computer generated paperwork typically includes picking lists and shipping documents.

Logic for producing hardcopy customer confirmations may be helpful. Confirmations are typically printed immediately following the creation of all the line items.

The order entry process should include an available-to-promise check for each line item on the customer order. As explained in Chapter 4, Master Production Scheduling, by promising customer orders using the available-to-promise calculation new customer orders can be slotted for shipment based on the existing master production schedule.

There are a number of different ways to do an available-to-promise check:

1. In cases where the customer promise is made before the order is entered, the available to promise has to be checked prior to the actual entry.
   A. Done using the master production schedule report or display.
   B. Done using special on-line promising displays to automate the checking and promising process.
2. The available to promise checked as the order is entered, with items not available on the requested date highlighted and shown with both the requested date and the available date for review by a person.
3. Available-to-promise check run after the order is entered with orders not available on the requested date listed on a report or in an on-line display for repromising.

An automated check of the available to promise normally works by comparing the cumulative available to promise on the request date with the quantity required on the customer order. The available to promise for the first period is the on-hand balance plus master schedule orders due in the past or current period less all customer orders due before the end of the first period. For later periods, the available to promise is the prior period available to promise plus any master schedule orders less any customer orders for the period. The customer order quantity is compared to the available-to-promise quantity for the period of the request date. If the available to promise is greater than or equal to the requirement, then the line item can be promised.

If the available to promise is less than that required, then a person has to make a decision about the importance of changing the master production schedule for this single customer order. A good master production schedule policy recognizes that there is an expense in direct and setup labor, inventory, overhead, and confusion for each change to the master production schedule. Yet changes can and should be made to the schedule. The policy should be to provide an evaluation of the effects and cost of each change prior to the change being made.

The order entry system requires some additional capabilities to handle customer orders for products made-to-order from a number of options. This type of product is like the automobile described in the master production scheduling chapter (Chapter 4). For automobiles, modules exist for V-8 and V-6 engines, AM-FM radios, accessory trim packages, etc. These modules may be actual subassemblies that are stocked and then put into the automobile (for example, the V-6 and V-8 engine options), or they may be logical groupings of parts that cannot physically be assembled (like accessory trim packages). The parts associated with this type

of module are put together with the parts of other modules to create a number of different subassemblies, like the front and rear door subassemblies.

In this type of product, the customer order is not for a specific finished item number from a product catalog. Instead, the customer order is for a type of product and a series of options. For example, the customer order might be for a silver Buick Skylark automobile with V-6 engine, AM/FM cassette stereo, special trim, etc. The customer order is the only unique product identifier, and it is entered at two levels: for the type of product (Buick Skylark) and modules and options (Buick Skylark common parts module, V-6 engine option, AM/FM cassette option, etc.).

For products made from options, the order entry mechanism should include two additional capabilities:

1. Assistance in selecting the proper modules and options for the product.
2. A check of the available to promise for both the type of product and each option.

The order entry mechanism should provide a menu of available choices for each type of product. For example, the order entry system should prompt for the entry of the type of product; show that an engine option is required, displaying the available choices of engines; show that the transmission option is required, displaying the available choices for transmissions, etc. And, since not all options necessarily work with all other options (for example, in the case of the Buick Skylark, the 5-speed manual transmission option may only be available with the 4-cylinder engine), the system should eliminate the choices that are not valid based on earlier choices. This way, once the order entry person picked a Skylark with 6-cylinder engine, the system would not show the 5-speed transmission as an available option.

For a product made from options, the customer request date is a single date, but product availability is based on the dates of the individual options and modules. Consequently, the order entry mechanism should check the available to promise for the type of product and the available to promise for each product option. If all of the modules and options are not available by the requested date, then the order should be flagged for human review and approval.

METHOD FOR ANALYZING CUSTOMER ORDERS

Not all customer orders are necessarily part of the forecast. Sometimes major orders are received from new customers, and sometimes high-impact orders are forthcoming from new, unanticipated market segments. At other times, changes in the marketplace may be signaled by significant increases (or decreases) in customer order demands.

Unless mechanisms exist to identify abnormal demands (and give them some type of special handling) and to pick up trends in the marketplace, a company may jeopardize its ability to service existing customers that are part of the forecast. Abnormal demands are not part of the forecast, they are in addition to the

forecast quantities. Major volume increases indicate that the forecast is being oversold and that the forecast needs to be revised. If the system assumes that these abnormal demands or volume increases replace the forecast, then the total demand for the item will be significantly understated in the system. Not enough of the required items will be built to satisfy the real demands. Eventually, the excitement of the major new accounts may be dampened by the problems that come from being without a product genuinely needed to support the needs of long-term, loyal customers.

Consequently, some method is needed to assist in analyzing incoming customer orders. This has two parts:

1. Computer logic to compare existing customer orders to the forecast for the purpose of identifying demands that may be abnormal, or major shifts in the marketplace.
2. A way to code demands that have been identified as abnormal.

The volume of orders promised in many companies makes identifying abnormal demands manually a challenging, if not impossible, job. For this reason, simple computer logic to compare customer orders, individually and in groups, to forecasts is helpful. This logic can assist in identifing abnormal demands.

Generally, companies set up some simple rules, such as:

1. Individual customer orders that exceed X% of the forecast quantity for the period are potentially abnormal.
2. Total customer orders exceeding Y% of the forecast for a specified period may be abnormal or indicative of an upward business trend that should be reviewed.
3. Customer orders less than Z% of the forecast for a specified period may be indicative of a downward business trend that should be reviewed.
4. Total customer orders through a period (all the orders between the current date and the specified future period) exceeding some specified percentage of the total forecast may be abnormal or indicative of an upward business trend that should be reviewed.
5. Total customer orders through a period (all the orders between the current date and the specified future period) less than some specified percentage of the total forecast may be indicative of a downward business trend that should be reviewed.
6. An unsold forecast quantity that has fallen past due and that exceeds some percentage of the month's forecast may be indicative of a downward trend that requires review.

Customer orders in excess of the limits can be coded as abnormal demands automatically, or listed on an exception report for review by someone who can evaluate the situation. A person would be responsible for reviewing the situation and deciding if additional actions should be taken. This way, early communication

with the customer may avert bad commitments and future service problems. In situations where the customer orders are less than the limits, the items should be listed on an exception report for human review.

Abnormal demands should be excluded from the forecast consumption logic that is part of the system (and described below). Abnormal demands should be added to the remaining forecast, other customer orders, etc. to compute total demand against the master schedule. Demands coded as abnormal may need to be excluded from the forecasting process because they represent events not likely to happen again in the future.

FORECAST CONSUMPTION LOGIC

The system should also include a method to reduce the forecast by customer orders that are part of the forecast. The objective of this forecast consumption logic is to most accurately represent the needs of the marketplace based on current projections and actual orders. By consuming the forecast properly it is possible to compute total customer demand for each period, taking into account timing differences between the actual customer orders and the forecast. These timing differences can occur when customer demands match the forecast quantities, but are for different dates than those anticipated.

Forecast consumption logic can be done in either of two places:

1. As customer orders are entered.
2. In a separate calculation that is run periodically.

Either of these two methods is workable. In the first case, the unconsumed forecast is updated as each customer order is entered. The system finds the proper unconsumed forecast quantities and reduces them by the customer order quantity. In the second case, the forecast consumption logic is part of a separate calculation and not part of the order entry process. In other words, the forecast is left unchanged as customer orders are received. In a separate computation, either as part of the master production schedule report or a separate batch run, the customer orders are combined with the original forecast to compute the unconsumed forecast.

In each of these methods, both the original forecast and the unconsumed forecast are stored in the system. The original forecast is needed so that customer orders can be reanalyzed periodically to identify potentially abnormal demands and trends. By storing the unconsumed forecast, the master scheduling and material requirements planning logic is simplified. The unconsumed forecast can be added to the other demands to compute total demand for the item. No forecasts consumption calculations are required in the MRP or master production scheduling logic to combine the original forecast and the customer orders.

In the forecast consumption logic that is part of the system, the forecast should be reduced in the period in which the customer order is requested. If demand exceeds the forecast in the period, the system can reach ahead or back to reduce forecasts in other time periods.

It is also necessary to provide logic to handle forecasts and customer orders that fall past due. It is incorrect to drop off the unconsumed forecast at the end of each week. In most situations, this has the effect of changing the forecast—even though no change was intended or indicated. For example, take the situation where the original forecast for a month was forty, split into four weekly quantities of ten. At the end of week one, only seven have been sold. Should the system drop the unsold three from the forecast? If so, the forecast has now been revised from forty to thirty-seven? Or should the remaining three units accumulate as an unsold forecast, in effect leaving the original forecast of forty for the month without change?

The simplest way to handle this problem is to specify the number of weeks that should be accumulated in the past due time period before being dropped. For example, four weeks could be specified. Unconsumed forecasts would accumulate in the past for a month, and then be dropped automatically. In most situations, an exception report should list the forecasts that were dropped automatically; this way, a person can review the situation and add back a forecast quantity if it was dropped in error.

When the forecast consumption logic is part of a separate batch process in the system, some additional logic is needed in the mechanism that drops unconsumed forecasts. This additional logic recodes any past due customer orders in the system as abnormal demands when the unconsumed forecasts are dropped. This prevents the system from incorrectly consuming the forecast in future time periods with these customer orders.

An effective system includes a calculation of total demand that summarizes the unconsumed forecast, normal and abnormal customer orders, dependent demands, distribution requirements, and interplant orders by date. This total demand is used in developing and managing the sales and operations plan and the master production schedule.

INDEPENDENT DEMAND

The system must also provide a way to enter independent demands into the MRP system. These independent demands are not apart of the master production schedule but are included in MRP.

This method for entering independent demands into the system is used for spare parts as well as items where the need for human control through the master production schedule is not needed. These items have no significant effect on capacity or materials, and no human evaluation is needed to evaluate the need or ability to change the schedule.

Independent demands are entered into MRP as gross requirements. The gross requirements are added to any exploded gross requirements to give the total gross requirements that are used in the logic of MRP. Normal netting, exception checking, and order planning take place.

The same functions for analyzing abnormal demands and handling past due forecasts in the master scheduling system should be available for independent demands entered directly into MRP.

Chapter 21

Distribution Resource Planning

Distribution Resource Planning is MRP II in a distribution environment. A distribution network needs the same kinds of scheduling information that is needed in scheduling a factory. Knowing what is needed and when is just as important in a distribution network as it is in a factory. This same kind of information is also needed for a multiplant operation; each of the plants need to know what is needed and when. Consequently, this explanation of Distribution Resource Planning covers both MRP II in a distribution environment and MRP II in a multiplant operation.

Distribution Resource Planning allows visibility into the entire distribution network. It allows the central facility to see the actual demands for products that will be needed at the distribution centers. The picture of demand at the central facility is like that of any other dependent demand item. The demand is lumpy. In some weeks the requirements far exceed the average, and in others there are few or even no requirements at all. The demands from the distribution centers on the central facility are visible as far into the future as the planning horizon extends.

Distribution Resource Planning also provides an accurate picture of the transportation loading and scheduling needed to support the distribution schedule. Using the projection of transportation requirements by volume, weight, and number of pallets, and the tools of MRP, a transportation planner can do a more effective job of truck and freight car loading.

The same type of advantages exist in a multiplant operation. The supplying plants are able to truly see into the receiving plants. The requirements for material and transportation are clear, and the interplant communication allows planners and master scheduler at the supplying plant to see the requirements as far into the future as the planning horizon extends.

DRP TRANSACTIONS

The basis for Distribution Resource Planning is a material requirements planning calculation done for each item at each distribution center or receiving plant. For eaeh stock keeping unit (SKU) at a distribution center, MRP is run using the forecast and any customer orders that are promised for future delivery as gross

requirements. For the receiving plants, the master production schedule would be the source of requirements for component items.

In any case, the normal MRP logic nets these requirements against the on-hand balance, safety stock, and any scheduled receipts (in-transit orders on the way to this branch warehouse or receiving plant) for the stock keeping unit. Planned orders are created to cover the remaining gross requirements using the lot sizing rule for the SKU. These planned orders will be supplied by the central facility, and so they are offset by the lead time for the SKU, exploded, and appear in the master schedule report for the central facility or supplying plant as a type of demand.

There are several different ways to translate the planned orders at the distribution centers and receiving plants into demands on the master production schedule for the supplying facility. They are:

1. Using a single data base and bills of material to represent the distribution network. Each stock keeping unit at each logication has a separate item number, typically the product item number and a location identifier.
2. Using a single data base and a source code on each item/location to identify the manufacturing source for that stock keeping unit. A computer program translates planned orders for one location into demands on the master schedule at the source location.
3. Using separate data bases and a computer program or programs to translate planned orders at the DCs to demand on the master production schedule.

The bill of material method requires that each stock keeping unit in each warehouse has a unique item number. This unique item number is typically the item number at the supplying facility plus the warehouse or receiving plant number. Then a bill of material is created showing the item number at the receiving location being made from the item number at the central supply location. By including a bill of material, the planned orders at the receiving locations will be exploded and gross requirements will be posted to the master schedule at the supply location.

The second method is similar. Each stock keeping unit has a unique item number, typically the item number from the supplying facility and a location identifier. In addition, a code is stored for each SKU to identify the source location. The MRP logic is run for each SKU at a location. Then each planned order is sent to the supplying location as gross requirements. When this method is used, additional explosion logic must be added to the system to properly handle the transfer of the gross requirements.

Another way to show the branch warehouse and multiplant demands is to have separate data bases for the different warehouses or receiving plants and the central supply facility. MRP is run for each of the warehouses or receiving plants. The planned orders are then sent as gross requirements from the branch warehouse or receiving plant MRP systems to the master production schedule at the supplying location. These gross requirements are treated as demands in the master schedul-

ing system for the central facility. When this method is used, logic is included in the system to handle the transfer of the gross requirements.

IN-TRANSIT INFORMATION

In a distribution or multiplant environment it is also necessary to show the material that is in transit to the MRP system. This material is a scheduled receipt for the receiving location. The system that maintains these scheduled receipts functions like the system that maintains manufacturing scheduled receipts. When a movement is created to ship material from the central facility to a distribution center or receiving plant, the items in the central facility are allocated to the shipment and a scheduled receipt is created at the receiving location. When the items are shipped from the central facility, the on-hand balance and the allocation are reduced. When the items are received at the branch warehouse or receiving plant, the scheduled receipt is reduced and the on-hand balance is increased. This same process can also be used when items are shipped from one warehouse to another.

While the system for items that are in transit is similar to the manufacturing scheduled receipts system, there are also some differences. Items that are in transit require that shipment information be stored for the movement. In addition to the movement number, item number, quantity, and date, this information includes things like the shipper, means of shipment, freight cost, value of the shipment, insurance, and an indication of what is in transit and what has not been shipped. For this reason, many times a separate system is used to maintain the information on items that are in transit. Other times, the scheduled receipts system for manufacturing items is modified to allow this type of information to be stored.

TRANSPORTATION PLANNING

Transportation planning is an integral part of DRP. Accurate transportation scheduling and loading, such as accurate capacity requirements planning in a manufacturing environment, is a necessity if a distribution network is to be managed effectively.

Transportation planning is a way to plan the weight, volume, and number of pallets to be shipped based on the distribution resource plan. Transportation planning simulates these transportation requirements for the purpose of taking advantage of freight rates. By simulating the transportation requirements, a company can see which periods have less than full truckloads or railcars. By adjusting the shipping schedule to ship full truckloads or railcars, at the greatest possible weight, a transportation planner can take advantage of the best rates, and, as a result minimize freight costs. A real benefit is that the products that must be shipped early (in order to have full truckloads) can be determined well in advance, rather than left to chance or to what's available at the time the trucks are being loaded.

The logic of transportation planning is similar to that Capacity Requirements Planning. In Capacity Requirements Planning, the planned order quantities are extracted from MRP and extended by the standard hours for each operation in the

routing. The capacity requirements are then summarized and displayed for each work center and time period.

In transportation planning, the unshipped distribution orders and firm planned and planned orders for the distribution centers or receiving plants are extracted from DRP and extended by the product weight (for example, pounds) and package volume (cubic feet), and divided by the quantity of the product that will fit on a pallet or container. These transportation requirements are scheduled for the start date of each planned order. After the transportation requirements have been generated, they are summarized and displayed by time period.

A transportation planning report displays the weight, volume, and number of pallets required to ship to each distribution center in each week. Using this report, a distribution planner can see into the DRP system, anticipate problems in freight car loading, and solve them while there is still time enough to ship the right products.

A transportation planning system must include a transportation planning summary report and a report showing the details of the transportation requirements. A transportation planning summary report or display shows the totals of the transportation requirements by destination and shipping method, including:

1. Destination and shipping method descriptive information.
2. Transportation planning periods (days, weeks, etc.).
3. Required weight, volume, and number of pallets.
4. Available transportation capacity in weight, volume, and number of pallets.
5. Amount over/under available capacity.

A display of the transportation requirements details is needed to solve transportation planning problems. This display shows the individual shipments that make up the total transportation requirements.

Many companies plan transportation requirements in weekly time periods, although in some cases it may be essential to plan daily transportation requirements. An example of needing to plan daily transportation requirements is a high volume manufacturer of cigarettes or soft drinks. No finished goods storage space exists, and product must be shipped daily or more frequently to the distribution sites. In this case, planning daily transportation requirements is essential.

One helpful feature in a transportation planning system is a way to vary the transportation capacity in each period. For example, in week twenty a company may be adding an additional truck to its company-owned fleet. In this situation, a transportation planner will want to increase the capacity available in week twenty and each subsequent period.

FIXED SHIPPING SCHEDULES

Many distribution companies work to fixed shipping schedules. A fixed shipping schedule establishes the specific days and weeks on which material is shipped to each distribution center. For example, one shipping schedule might be to ship

to the Seattle distribution center every third Thursday, to the Boston distribution center every other Tuesday, and to the Houston distribution center every Wednesday.

Working to a fixed shipping schedule solves several problems in distribution. For example, a fixed shipping schedule is one way to handle limitations in shipping doors and docks and in manpower and equipment at either the sending or receiving facility. A fixed shipping schedule is a simple way of leveling transportation load.

In a company with a fixed shipping schedule, the Distribution Resource Planning system must include a way to define a fixed shipping schedule and logic to adjust the planned shipments to the distribution centers to agree with the fixed shipping schedule. DRP may plan an order to be shipped to the Seattle distribution center on Wednesday of week four. If the shipping schedule for Seattle is Thursday of weeks two, five, and eight, DRP will not be a true simulation of what will actually happen.

In this situation, the planned order should be adjusted to ship on Thursday of week two and an action message indicating that the order is scheduled for shipment earlier than needed should be produced for the planner. This way, DRP will be an accurate simulation for the resupply, and the master scheduler will be able to see that the material is really needed in week two. The action message provides a way for the planner to see into the system and to verify that what the system has done makes sense.

There are two methods for adjusting the planned order dates to the shipping schedule. One method is to calculate the planned orders based on the date the items are needed in the distribution centers. An additional calculation in the order planning logic would then adjust the dates to the shipping schedule. The planned orders would be moved to the next earlier shipping date.

The other method would be to use a separate program that adjusts the planned orders after DRP has created and stored them. This computer program would read the planned orders, adjust them to the next earlier shipping date, and, if necessary, update the distribution demands on the master production schedule. This method of having a separate program is often used when it is difficult, or impractical, to modify the logic of MRP in a software package.